

## NEUROMAPPING: INFLIGHT EVALUATION OF COGNITION AND ADAPTABILITY

I.S. Kofman<sup>1</sup>, Y.E. De Dios<sup>1</sup>, K. Lawrence<sup>2</sup>, A. Schade<sup>2</sup>, M.F. Reschke<sup>3</sup>, J.J. Bloomberg<sup>3</sup>, S.J. Wood<sup>4</sup>, A.P. Mulavara<sup>5</sup>, R.D. Seidler<sup>6</sup>

<sup>1</sup>Wyle Science, Technology and Engineering Group, Houston, TX 77058, <sup>2</sup>Lockheed Martin, Houston, TX 77058, <sup>3</sup>NASA Johnson Space Center, Houston, TX 77058, <sup>4</sup>Azusa Pacific University, Azusa, CA 91702, <sup>5</sup>Universities Space Research Association, Houston, TX 77058, <sup>6</sup>University of Michigan, Ann Arbor, MI 48109

### BACKGROUND

In consideration of the health and performance of crewmembers during flight and postflight, we are conducting a controlled prospective longitudinal study to investigate the effects of spaceflight on the extent, longevity and neural bases of sensorimotor, cognitive, and neural changes. Previous studies investigating sensorimotor adaptation to the microgravity environment longitudinally inflight have shown reduction in the ability to perform complex dual tasks. In this study we perform a series of tests investigating the longitudinal effects of adaptation to the microgravity environment and how it affects spatial cognition, manual visuo-motor adaption and dual tasking.

### METHODS

The NeuroMapping inflight software was developed in accordance with the International Space Station (ISS) Program's Display and Graphics Commonality Standard (SSP 50313, Revision D). The software was installed on a Lenovo T61p laptop mounted on Human Research Facility rack in the Columbus Module of the ISS. A USB gamepad controller (a commercial Logitech model modified for flight) is used by test subjects for responding to stimuli presented during the test.

The test takes about 20 minutes to complete and comprises 4 tasks as follows. Detailed instructions complete with demo videos are displayed prior to each task.

1. *Mental Rotation I.* Subjects memorize and subsequently identify a match to a re-oriented 3D cube assemblage
2. *Sensorimotor Adaptation.* Subjects move a cursor from center to target locations using a joystick under normal or rotated visual feedback.
3. *Dual Task.* Subjects press buttons matched to a pseudo-random pattern of highlighted positions of stimulus boxes while also monitoring for the occurrence of a target color.
4. *Mental Rotation II.* Same as task 1.

The first three tasks are performed in strapped-in configuration mimicking a seated position – waist bungees pulling the crewmember toward the “floor”, feet secure in foot loops. Task 4 is performed in free-floating configuration – no bungees or foot loops, test subject is floating while holding on to the controller secured on the rack.

Astronauts participating in the NeuroMapping study perform testing about every two months for a total of 3 times during a nominal 6-month mission (6 times for 1-year mission crew).

### DISCUSSION

To date, one crewmember has completed the study and data are being obtained from several other participants on the ISS who have completed multiple test sessions each. We will be presenting the NeuroMapping inflight software and discussing the data obtained from these subjects and their performance of the tasks longitudinally over the duration of stay on the ISS.

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